WHAT IS CLAIMED IS:

1. A method for simulating the heating of a plastic preform comprising the following steps:

inputting a preform geometry into a preform design program;

providing oven geometry and calculating spatial location of said preform through at least one oven;

providing heating information and calculating temperatures of primary and secondary heating sources;

solving energy equations based upon said preform geometry, said spatial location of said preform, said temperatures, cooling air and absorption spectra of a material of said preform; and

computing at least one cross sectional thermal profile of a final heated preform.

2. The method of claim 1 further comprising the step of providing a stress/strain behavior of said material and simulating stretch blow molding of said heated preform;

3. The method of claim 1 further comprising the step of generating a bottle geometry for a bottle design.

4. The method of claim 3 further comprising the step of determining a bottle wall thickness profile.

5. The method according to claim 1 including performing a design optimization routine.

6. The method according to claim 5 including incorporating the geometry of an existing preform to determine its fitness for use in a specific application.

7. The method according to claim 1 wherein said step of solving energy equations includes determining an emission spectra of said primary and secondary heating sources.

8. The method according to claim 1 wherein said step of solving energy equations includes determining an absorption radiation of said preform.

9. The method according to claim 8 wherein said step of determining said absorption radiation includes discretizing said preform into a plurality of blocks of a respective volume, wherein said absorption radiation is determined for each of said plurality of blocks.

10. The method according to claim 9 wherein said step of determining said absorption radiation includes determining a view factor, said view factor characterized as radiation spectra of said primary heating sources incident to each of said plurality of blocks of said preform at a respective oven location, said view factor provided by the formula

$$V_f = (1/\pi)\int dA_p \int \mathrm{Cos}\varphi \mathrm{Cos}\theta \; dA_h/r^2$$

where A_p is an area said preform, A_h is an area of a heater, φ is an angle between normal to a preform surface and an incremental area on said heater, θ is an angle between a normal to heater surface and an incremental area on said preform, and r is a distance between normal surface A_p and A_h.

11. The method according to claim 10 wherein said radiation spectra transmitted through a respective block of said preform is provided as an input for determining said absorption radiation incident to a next adjacent block.

12. The method according to claim 1 wherein said step of providing a stress/strain behavior further comprises discretizing said preform into a plurality of sections.

13. The method according to claim 12 wherein said step of providing a stress/strain behavior further comprises determining an axial orientation and hoop orientation.

14. The method according to claim 13 wherein said axial orientation and said hoop orientation is determined for each of said plurality of sections.

15. A method for the virtual prototyping of plastic containers comprising the following steps:

generating a bottle geometry for a bottle design;

inputting a preform geometry into a preform design program;

providing oven geometry and calculating spatial location of said preform through at least one oven;

providing heating information and calculating temperatures of primary and secondary heating sources;

solving energy equations based upon said preform geometry, said spatial location of said preform, said temperatures, cooling air and absorption spectra of a material of said preform;

computing at least one cross sectional thermal profile of a final heated preform;

providing a stress/strain behavior of said material and simulating stretch blow molding of said heated preform; and

determining a bottle wall thickness profile.

16. A method for the virtual prototyping of plastic containers comprising the following steps:

generating a bottle geometry for a bottle design;

generating a preform design for said bottle by means of a preform design program;

providing oven geometry and calculating spatial location of said preform through at least one oven;

providing heating information and calculating temperatures of primary and secondary heating sources;

solving energy equations based upon said preform geometry, said spatial location of said preform, said temperatures, cooling air and absorption spectra of a material of said preform;

computing at least one cross sectional thermal profile of a final heated preform;

providing a stress/strain behavior of said material and simulating stretch blow molding of said heated preform; and

determining a bottle wall thickness profile.

17. An apparatus for simulating the heating of a plastic preform comprising:

means for inputting a preform geometry into a preform design program;

means for generating oven geometry, said oven geometry defining oven parameters for providing a heating source to a preform, said oven geometry including spatial locations of said preform within said oven geometry;

means for generating primary and secondary temperature heating sources for providing energy to said preform; and

a preform heating module for:

(a) solving energy equations based on inputs from said preform geometry, said spatial location of said preform, said temperature heating sources, cooling air and spectra of a material of said preform;

(b) computing at least one cross-sectional thermal profile of a final heated preform.

18. The apparatus of claim 17 further comprising a blow-molding module for determining a stress/strain behavior of said material as a function of said temperatures derived in said preform heating module and simulating stretch blow molding of said final heated preform.

19. The apparatus of claim 17 further comprising a means for generating a bottle geometry for a bottle design.

20. The apparatus of claim 19 wherein said blow molding module determines a bottle wall thickness.

21 The apparatus of claim 17 further comprising a design optimization module for optimizing a material distribution efficiency of said preform.

22. An apparatus for virtual prototyping of plastic containers comprising:

means for generating a bottle geometry for a bottle design;

means for inputting a preform geometry into a simulation program;

means for generating oven geometry, said oven geometry defining oven parameters for providing a heating source to a preform, said oven geometry including spatial locations of said preform within said oven geometry;

means for generating primary and secondary temperature heating sources for providing energy to said preform;

a preform heating module for:

(a) solving energy equations based on inputs from said preform geometry, said spatial location of said preform, said temperature heating source, cooling air and spectra of a material of said preform;

(b) computing at least one cross-sectional thermal profile of a final heated preform;

a blow-molding module for:

(a) determining a stress/strain behavior of said material as a function of said temperatures derived in said preform heating module and simulating stretch blow molding of said heated preform;

(b) determining a bottle wall thickness; and

a design optimization module for optimizing a material distribution efficiency of said preform.